Citation:

Fulton, Jante E. et al Physical Activity, Energy Intake, Sedentary Behavior, and Adiposity in Youth *Am J Prev Med* 2009;37(1S): S40-S49

Study Design:

Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

Primary objective was to describe the relationship of physical activity, energy intake, and sedentary behavior with BMI, Fat Free Mass Index (FFMI) and Fat Mass Index (FMI). The hypothesis was that greater energy intake and time spent in sedentary behavior is directly associated with higher BMI and FMI, and more time spent in moderate to vigorous activity was inversely associated with BMI and FMI.

Inclusion Criteria:

Participants in Project Heartbeat age 10-14 years of age.

Exclusion Criteria:

Not stated in this article

Description of Study Protocol:

Recruitment : Participants in Project Heartbeat, a longitudinal study designed to evaluate cardiovascular disease risk factors and behavioral determinants in children and adolescents.

Design : Longitudinal study of three age cohorts. Repeated annual measurements were assessed.

Blinding used (if applicable): No

Intervention (if applicable): None

Statistical Analysis: Bivariate correlations. Multi-level modeling of BMI, fat free mass index (FFMI), and fat mass index (FMI). Alpha set at 0.05.

Data Collection Summary:

Timing of Measurements: Although repeat measures were taken throughout 4 years of participation, analysis was done yearly measurements taken at time of annual diet and physical activity assessment.

Dependent Variables

- BMI: calculated from weights taken using beam balance scale, and height measured with a wall mounted stadiometer. Formula for calculation: kg/meter squaredbrief description (how measured?)
- Body Fat: electrical impedance and anthropoetric measures brief description (how measured?)
- Fat Free Mass Index:: same as above
- Fat Mass Index: same as above

NOTE: Body Fat, FFMI, and FMI were calculated from above measurements using cross validated formulas

Independent Variables

- Physical Activity: recall questionaire
- Sedentary behavior: same as above
- Energy Intake: estimated from a food frequency questionaire and calculated using USDA Survey Nutrient Database

Control Variables

- Gender
- Sexual maturation
- Race

Description of Actual Data Sample:

Data sets were divided in groups: Cohort 1: aged 8 at entry and attained 10 years by followup assessment. Cohort 2: entered at 11 years, and Cohort 3 entered at 14 years.

Initial N: 678

Attrition (final N):472 (227 male, 245 female)

Age:Cohort 1 mean age 10.4 years, Cohort 2 mean age 11.5 years and Cohort 3 14.4 years.

Ethnicity: % non black were reported across cohort and gender. Range was 74.6-92.7. There was no information presented regarding similarity among groups.

Other relevant demographics: Sexual maturation stages were reported across groups. As expected due to age differences, groups differed in distribution of sexual maturation stages.

Anthropometrics (e.g., were groups same or different on important measures):

Location: Conroe, TX, USA

Summary of Results:

Key Findings:

The following factors were statistically significantly associated with the outcome variables In the final multivariate models after controlling for sexual maturation and gender:

For BMI:

- physical activity (MVPA) (inverse association)

Fat Free Mass Index:

- no intake or exercize variables

Fat Mass Index:

- physical activity (MVPA) (inverse association)

Energy intake and sedentary behavior were not associated with any of the outcomes in the final models.

Table: Correlation coefficients, adjusted for age between BMI and it's components. (FFM: fat free mass index, FMI: fat mass index, MVPA: moderate to vigorous physical activity, energy intake, and sedentary behavior)

	FFMI	FMI	MVPA	energy intake	sedentary behavior (min/d)
BMI	0.79*	0.90*	-0.14*	-0.10	0.04
FFMI	1.00	0.43*	-0.06	0.01	0.05
FMI	0.43*	1.00	-0.16*	-0.16*	0.02
MVPA	-0.06	-0.16*	1.00	0.14*	-0.13*
Energy Intake	0.01	-0.16*	0.14*	1.00	0.05

* significance at $p<0.05$

Author Conclusion:

In children aged 10-18 years, MVPA was inversely associated with fat mass and with BMI. Investigations in youth of dietary intake and physical activity, including interventions to prevent or reverse overweight as represented by BMI should address its fat and lean components and not BMI alone.

Reviewer Comments:

The article did not describe the methods of group assignment well, but rather referred to other articles from the same study (not analyzed here). So, it was impossible to fully assess the methodological quality of this study on its own merits.

This article demonstrated a number of important concepts related to body composition, changes with age and sexual maturation, and behavioral factors. The authors point out the limitations of BMI alone as an indicator of obesity. The article supports the impact of activity alone on body

composition, irrespective of energy intake and sedentary behavior. Although this article received a neutral rating, (based on the checklist questions and study design), I belive it contributes useful information to the body of evidence related to adiposity assessment and influential behaviors in children and adolescents.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.		Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.		Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.		Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.		Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**		Yes
	1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
	1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
	1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**		Yes
	2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
	2.2.	Were criteria applied equally to all study groups?	Yes
	2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
	2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**		No
	3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A

3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	No
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A

4. Was method of handling withdrawals described? — Yes

4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A

5. Was blinding used to prevent introduction of bias? — Yes

5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A

6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described? — Yes

6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	No

8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A

9. **Are conclusions supported by results with biases and limitations taken into consideration?** — Yes

9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes

10. **Is bias due to study's funding or sponsorship unlikely?** — Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes